



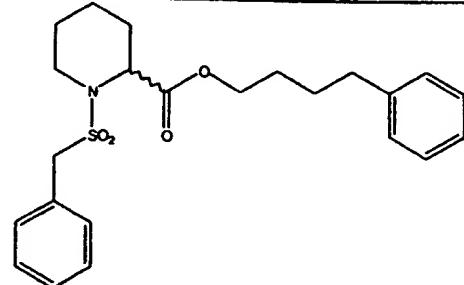
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/US98/19980</p> <p>(22) International Filing Date: 24 September 1998 (24.09.98)</p> <p>(30) Priority Data:</p> <table> <tr> <td>60/059,905</td> <td>24 September 1997 (24.09.97)</td> <td>US</td> </tr> <tr> <td>60/059,963</td> <td>25 September 1997 (25.09.97)</td> <td>US</td> </tr> <tr> <td>09/159,105</td> <td>23 September 1998 (23.09.98)</td> <td>US</td> </tr> </table> <p>(71) Applicant (<i>for all designated States except US</i>): AMGEN INC. [US/US]; One Amgen Center Drive, Thousand Oaks, CA 91320-1799 (US).</p> <p>(72) Inventor; and</p> <p>(75) Inventor/Applicant (<i>for US only</i>): MAGAL, Ella [IL/US]; 3022 Windrift Court, Thousand Oaks, CA 91360 (US).</p> <p>(74) Agents: ODRE, Steven, M. et al.; Amgen, Inc., One Amgen Center Drive, Thousand Oaks, CA 91320-1799 (US).</p>		60/059,905	24 September 1997 (24.09.97)	US	60/059,963	25 September 1997 (25.09.97)	US	09/159,105	23 September 1998 (23.09.98)	US	<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published <i>With declaration under Article 17(2)(a); without classification and without abstract; title not checked by the International Searching Authority.</i></p>	
60/059,905	24 September 1997 (24.09.97)	US										
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<p>(54) Title: METHOD FOR PREVENTING AND TREATING HEARING LOSS USING SENSORINEUROTROPHIC COMPOUNDS</p>												

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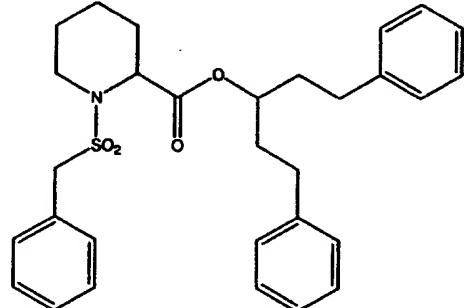
Table XL

Cpd.	Structure and name
278	



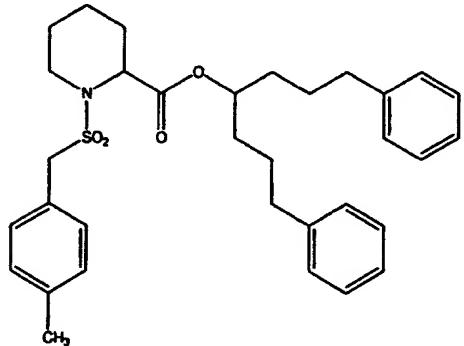
4-phenyl-1-butyl-1-(benzylsulfonyl)-(2R,S)-2-pipecolinate

279



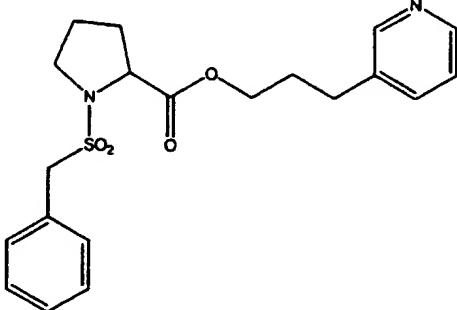
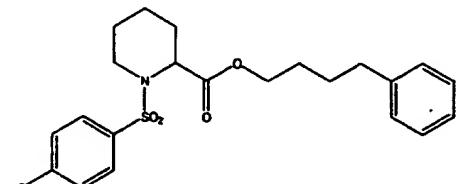
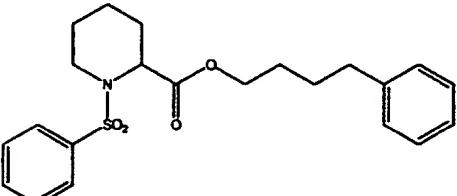
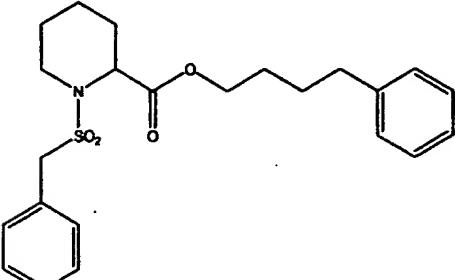
1,5-diphenyl-3-pentyl-N-(a-toluenesulfonyl)-2-pipecolate

280



1,7-diphenyl-4-heptyl-N-(para-toluenesulfonyl)pipecolate

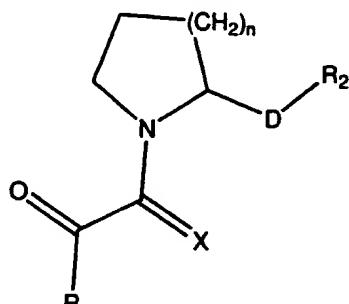
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Cpd.	Structure and name
281	 <p>3-(3-pyridyl)-1-propyl-(2S)-N-(a-toluenesulfonyl)-pyrrolidine-2-carboxylate</p>
282	 <p>4-phenyl-1-butyl-N-(para-toluenesulfonyl)pipecolate</p>
283	 <p>4-phenyl-1-butyl-N-(benzenesulfonyl)pipecolate</p>
284	 <p>4-phenyl-1-butyl-N-(a-toluenesulfonyl)pipecolate</p>

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VII. Carboxylic Acid Isosteres as Sensorineuro-trophic Compounds

Another especially preferred embodiment of the invention is a compound of formula (LXIV) :



5

(LXIV)

in which:

n is 1-3;

X is either O or S;

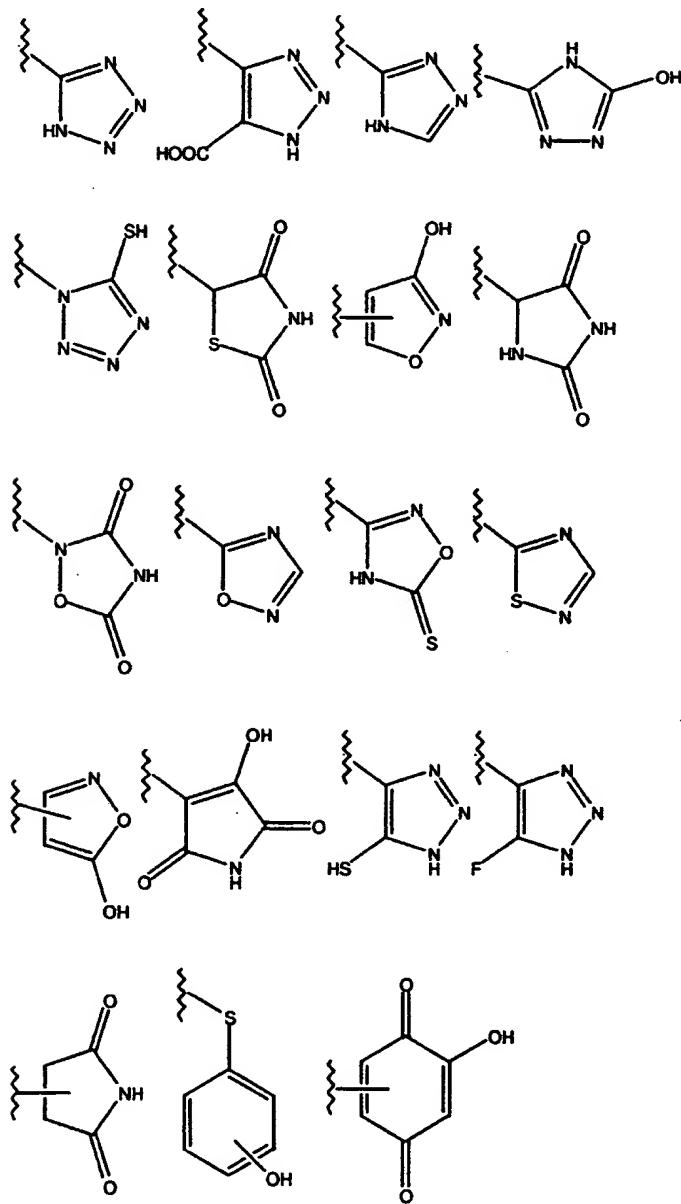
10 R<sub>1</sub> is selected from the group consisting of C<sub>1</sub>-C<sub>9</sub> straight or branched chain alkyl, C<sub>2</sub>-C<sub>9</sub> straight or branched chain alkenyl, aryl, heteroaryl, carbocycle, or heterocycle;

D is a bond, or a C<sub>1</sub>-C<sub>10</sub> straight or branched chain alkyl, C<sub>2</sub>-C<sub>10</sub> alkenyl or C<sub>2</sub>-C<sub>10</sub> alkynyl; and

15 R<sub>2</sub> is a carboxylic acid or a carboxylic acid isostere; or a pharmaceutically acceptable salt, ester, or solvate thereof;

20 Preferred embodiments of this invention are where R<sub>2</sub> is a carbocycle or heterocycle containing any combination of CH<sub>2</sub>, O, S, or N in any chemically stable oxidation state, where any of the atoms of said ring structure are optionally substituted in one or more positions with R<sup>3</sup>.

Especially preferred embodiments of this invention are where  $R_2$  is selected from the group below:



where the atoms of said ring structure may be optionally substituted at one or more positions with  $R^3$ .

Another preferred embodiment of this invention is where R<sub>2</sub> is selected from the group consisting of -COOH, -SO<sub>3</sub>H, -SO<sub>2</sub>HNR<sup>3</sup>, -PO<sub>2</sub>(R<sup>3</sup>)<sub>2</sub>, -CN, -PO<sub>3</sub>(R<sup>3</sup>)<sub>2</sub>, -OR<sup>3</sup>, -SR<sup>3</sup>, -NHCOR<sup>3</sup>, -N(R<sup>3</sup>)<sub>2</sub>, -CON(R<sup>3</sup>)<sub>2</sub>, -CONH(O)R<sup>3</sup>, -CONHNHSO<sub>2</sub>R<sup>3</sup>, -COHNSO<sub>2</sub>R<sup>3</sup>, and -CONR<sup>3</sup>CN wherein R<sup>3</sup> is hydrogen, hydroxy, halo, halo-C<sub>1</sub>-C<sub>6</sub>-alkyl, thiocarbonyl, C<sub>1</sub>-C<sub>6</sub>-alkoxy, C<sub>2</sub>-C<sub>6</sub>-alkenoxy, C<sub>1</sub>-C<sub>6</sub>-alkylaryloxy, aryloxy, aryl-C<sub>1</sub>-C<sub>6</sub>-alkyloxy, cyano, nitro, imino, C<sub>1</sub>-C<sub>6</sub>-alkylamino, amino-C<sub>1</sub>-C<sub>6</sub>-alkyl, sulfhydryl, thio-C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>1</sub>-C<sub>6</sub>-alkylthio, sulfonyl, C<sub>1</sub>-C<sub>6</sub> straight or branched chain alkyl, C<sub>2</sub>-C<sub>6</sub> straight or branched chain alkenyl or alkynyl, aryl, heteroaryl, carbocycle, heterocycle, and CO<sub>2</sub>R<sup>4</sup> where R<sup>4</sup> is hydrogen or C<sub>1</sub>-C<sub>6</sub> straight or branched chain alkyl or alkenyl.

Preferred embodiments of this invention are: (2S)-1-(1,2-dioxo-3,3-dimethylpentyl)-2-hydroxymethyl pyrrolidine; (2S)-1-(1,2-dioxo-3,3-dimethylpentyl)-2-pyrrolidinetetrazole; (2S)-1-(1,2-dioxo-3,3-dimethylpentyl)-2-pyrrolidinecarbonitrile; and (2S)-1-(1,2-dioxo-3,3-dimethylpentyl)-2-aminocarbonyl piperidine.

A compound of the present invention, especially formula LXIV, wherein n is 1, X is O, D is a bond, R<sub>1</sub> is 1,1-dimethylpropyl, and R<sub>2</sub> is -CN, is named (2S)-1-(1,2-dioxo-3,3-dimethylpentyl)-2-pyrrolidine-carbonitrile.

Specific embodiments of the inventive compounds are presented in Tables XLI, XLII, and XLIII. The present invention contemplates employing the compounds of Tables XLI, XLII and XLIII, below.

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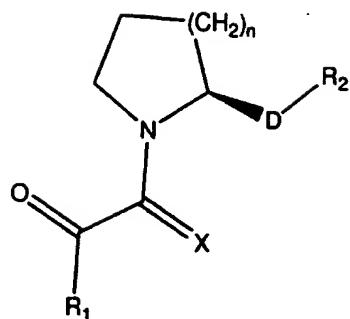


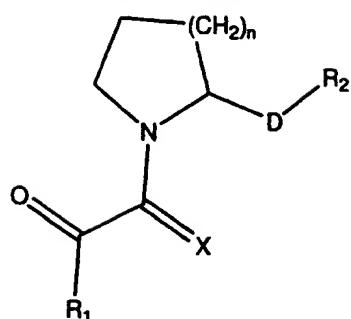
Table XLI

when D is a bond and R2 is COOH,

No.	X	n	R <sub>1</sub>
285	O	1	3,4,5-trimethylphenyl
286	O	2	3,4,5-trimethylphenyl
287	O	1	tert-butyl
287	O	3	tert-butyl
288	O	1	cyclopentyl
289	O	2	cyclopentyl
290	O	3	cyclopentyl
291	O	1	cyclohexyl
292	O	2	cyclohexyl
293	O	3	cyclohexyl
294	O	1	cycloheptyl
295	O	2	cycloheptyl
296	O	3	cycloheptyl
297	O	1	2-thienyl
298	O	2	2-thienyl
299	O	3	2-thienyl
300	O	1	2-furyl
301	O	2	2-furyl
302	O	3	2-furyl
303	O	3	phenyl
304	O	1	1,1-dimethylpentyl
305	O	2	1,1-dimethylhexyl
306	O	3	ethyl
307			

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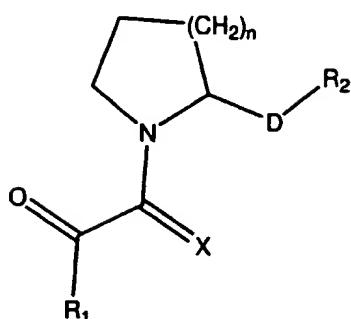
Table XLII



No.	X	n	R <sub>1</sub>	D	R <sub>2</sub>
308	S	1	1,1-dimethyl propyl	CH <sub>2</sub>	COOH
309	S	1	1,1-dimethyl propyl	bond	COOH
310	O	1	1,1-dimethyl propyl	CH <sub>2</sub>	OH
311	O	1	1,1-dimethyl propyl	bond	SO <sub>2</sub> H
312	O	1	1,1-dimethyl propyl	CH <sub>2</sub>	CN
313	O	1	1,1-dimethyl propyl	bond	CN
314	O	1	1,1-dimethyl propyl	bond	tetrazolyl
315	S	1	phenyl	(CH <sub>2</sub> ) <sub>2</sub>	COOH
316	S	1	phenyl	(CH <sub>2</sub> ) <sub>3</sub>	COOH
317	S	2	phenyl	CH <sub>2</sub>	COOH
318	O	1	1,1-dimethyl propyl	bond	CONH <sub>2</sub>
319	O	2	1,1-dimethyl propyl	bond	CONH <sub>2</sub>
320	S	2	2-furyl	bond	PO <sub>3</sub> H <sub>2</sub>
321	O	2	propyl	(CH <sub>2</sub> ) <sub>2</sub>	COOH
322	O	1	propyl	(CH <sub>2</sub> ) <sub>3</sub>	COOH
323	O	1	tert-butyl	(CH <sub>2</sub> ) <sub>4</sub>	COOH
324	O	1	methyl	(CH <sub>2</sub> ) <sub>5</sub>	COOH
325	O	2	phenyl	(CH <sub>2</sub> ) <sub>6</sub>	COOH
326	O	2	3,4,5-trimethoxy-phenyl	CH <sub>2</sub>	COOH
327	O	2	3,4,5-trimethoxy-phenyl	CH <sub>2</sub>	tetrazolyl

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TABLE XLIII



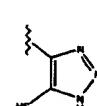
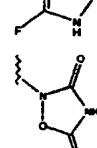
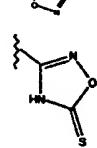
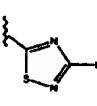
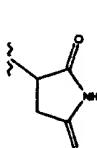
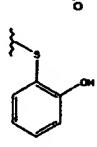
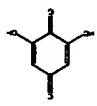
No.	n	X	D	R <sub>1</sub>	R <sub>2</sub>
328	1	S	bond	COOH	Phenyl
329	1	O	bond	COOH	α-MethylBenzyl
330	2	O	bond	COOH	4-MethylBenzyl
331	1	O	bond	Tetrazole	Benzyl
332	1	O	bond	SO <sub>2</sub> H	α-MethylBenzyl
333	1	O	CH <sub>2</sub>	COOH	4-MethylBenzyl
334	1	O	bond	SO <sub>2</sub> HNMe	Benzyl
335	1	O	bond	CN	α-MethylBenzyl
336	1	O	bond	PO <sub>2</sub> H <sub>2</sub>	4-MethylBenzyl
337	2	O	bond	COOH	Benzyl
338	2	O	bond	COOH	α-MethylBenzyl
339	2	O	bond	COOH	4-MethylBenzyl
340	2	S	bond	COOH	3,4,5-trimethoxyphenyl
341	2	O	bond	COOH	Cyclohexyl
342	2	O	bond	PO <sub>2</sub> HET	i-propyl
343	2	O	bond	PO <sub>2</sub> HPropyl	ethyl
344	2	O	bond	PO <sub>2</sub> (Et) <sub>2</sub>	Methyl
345	2	O	bond	OMe	tert-butyl
346	1	O	bond	OEt	n-pentyl
347	2	O	bond	OPropyl	n-hexyl
348	1	O	bond	OButyl	Cyclohexyl
349	1	O	bond	OPentyl	cyclopentyl
350	1	O	bond	OHexyl	n-heptyl
351	1	O	bond	SMe	n-octyl
352	1	O	bond	SEt	n-nonyl
353	2	O	bond	SPropyl	2-indolyl
354	2	O	bond	SButyl	2-furyl
355	2	O	bond	NHCOMe	2-thiazolyl

No.	n	X	D	R <sub>2</sub>	R <sub>1</sub>
356	2	O	bond	NHCOEt	2-thienyl
357	1	O	CH <sub>2</sub>	N(Me),	2-pyridyl
358	1	O	(CH <sub>2</sub> ) <sub>2</sub>	N(Me)Et	1,1-dimethylpropyl
359	1	O	(CH <sub>2</sub> ) <sub>3</sub>	CON(Me) <sub>2</sub>	1,1-dimethylpropyl
360	1	O	(CH <sub>2</sub> ) <sub>4</sub>	CONHMe	1,1-dimethylpropyl
361	1	O	(CH <sub>2</sub> ) <sub>5</sub>	CONHEt	1,1-dimethylpropyl
362	1	O	(CH <sub>2</sub> ) <sub>6</sub>	CONHPropyl	1,1-dimethylpropyl
363	1	O	bond	CONH(O)Me	Benzyl
364	1	O	bond	CONH(O)Et	α-Methylphenyl
365	1	O	bond	CONH(O)Propyl	4-Methylphenyl
366	1	O	(CH <sub>2</sub> ) <sub>2</sub>	COOH	Benzyl
367	1	O	bond	COOH	α-Methylphenyl
368	1	O	bond	COOH	4-Methylphenyl
369	1	O	CH <sub>2</sub>	COOH	1,1-dimethylpropyl
370	1	O	(CH <sub>2</sub> ) <sub>2</sub>	COOH	1,1-dimethylbutyl
371	1	O	(CH <sub>2</sub> ) <sub>3</sub>	COOH	1,1-dimethylpentyl
372	1	O	(CH <sub>2</sub> ) <sub>4</sub>	COOH	1,1-dimethylhexyl
373	1	O	(CH <sub>2</sub> ) <sub>5</sub>	COOH	1,1-dimethylethyl
374	1	O	(CH <sub>2</sub> ) <sub>6</sub>	COOH	iso-propyl
375	1	O	(CH <sub>2</sub> ) <sub>7</sub>	COOH	tert-butyl
376	1	O	(CH <sub>2</sub> ) <sub>8</sub>	COOH	1,1-dimethylpropyl
377	1	O	(CH <sub>2</sub> ) <sub>9</sub>	COOH	benzyl
378	1	O	(CH <sub>2</sub> ) <sub>10</sub>	COOH	1,1-dimethylpropyl
379	1	O	C <sub>2</sub> H <sub>5</sub>	COOH	cyclohexylmethyl
380	1	O	2-OH, Et	COOH	1,1-dimethylpropyl
381	1	O	2-butylene	COOH	1,1-dimethylpropyl
382	1	S	i-Pro	COOH	1,1-dimethylpropyl
383	2	S	t-Bu	COOH	phenyl
384	2	O	2-NO <sub>2</sub> -hexyl	COOH	1,1-dimethylpropyl
385	1	O	(CH <sub>2</sub> ) <sub>11</sub>	CN	1,1-dimethylpropyl
386	1	O	(CH <sub>2</sub> ) <sub>12</sub>	CN	1,1-dimethylpropyl
387	3	O	bond	CONHNHSO <sub>2</sub> Me	Benzyl
388	3	O	bond	CONHNHSO <sub>2</sub> Et	α-Methylphenyl
389	3	O	bond	CONHSO <sub>2</sub> Me	4-Methylphenyl
390	1	O	bond	CONHNHSO <sub>2</sub> Et	Phenyl
391	2	O	bond	CON(Me)CN	α-Methylphenyl
392	1	O	bond	CON(Et)CN	4-Methylphenyl
393	1	O	(CH <sub>2</sub> ) <sub>2</sub>	COOH	methyl

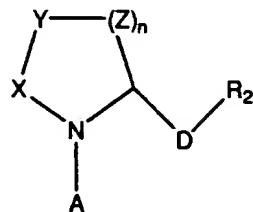
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No.	n	X	D	R <sub>2</sub>	R <sub>1</sub>
394	1	O	(CH <sub>2</sub> ) <sub>3</sub>	COOH	ethyl
395	1	O	(CH <sub>2</sub> ) <sub>3</sub>	COOH	n-propyl
396	1	O	(CH <sub>2</sub> ) <sub>3</sub>	COOH	t-butyl
397	1	O	(CH <sub>2</sub> ) <sub>3</sub>	COOH	Pentyl
398	1	O	(CH <sub>2</sub> ) <sub>3</sub>	COOH	Hexyl
399	1	O	(CH <sub>2</sub> ) <sub>3</sub>	COOH	Heptyl
400	1	O	(CH <sub>2</sub> ) <sub>3</sub>	COOH	Octyl
401	1	O	C <sub>6</sub> H <sub>5</sub>	COOH	Cyclohexyl
No.	n	X	D	R <sub>2</sub>	R <sub>1</sub>
402	2	O	bond		1,1-dimethylpropyl
403	1	O	bond		1,1-dimethylpropyl
404	1	O	bond		1,1-dimethylpropyl
405	1	O	bond		1,1-dimethylpropyl
406	1	O	bond		1,1-dimethylpropyl
407	1	O	bond		1,1-dimethylpropyl
408	1	O	bond		1,1-dimethylpropyl
409	1	O	bond		1,1-dimethylpropyl
410	1	O	bond		1,1-dimethylpropyl
411	1	O	bond		1,1-dimethylpropyl

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No.	n	X	D	R <sub>2</sub>	R <sub>1</sub>
412	1	O	bond		1,1-dimethylpropyl
413	1	O	bond		1,1-dimethylpropyl
414	1	O	bond		1,1-dimethylpropyl
415	1	O	bond		1,1-dimethylpropyl
416	1	O	bond		1,1-dimethylpropyl
417	1	O	bond		1,1-dimethylpropyl
418	1	O	bond		1,1-dimethylpropyl
419	1	O	bond		1,1-dimethylpropyl
420	1	O	bond		1,1-dimethylpropyl
421	1	O	bond	COOH	1,1-dimethylpropyl
422	2	O	bond	COOH	1,1-dimethylpropyl

Another preferred embodiment of this aspect of the invention is the use for treating or preventing sensorineural hearing loss of a compound of the formula (LXV) :



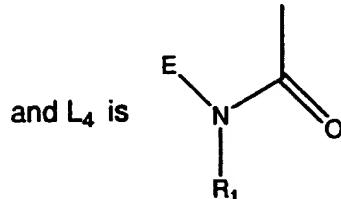
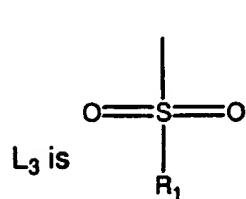
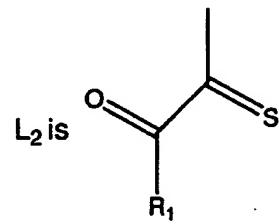
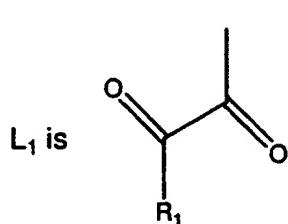
(LXV)

in which

5 X, Y, and Z are independently selected from the group consisting of C, O, S, or N, provided that X, Y, and Z are not all C;

n is 1-3;

A is selected from the group consisting of L<sub>1</sub>, L<sub>2</sub>, L<sub>3</sub>, or L<sub>4</sub>, in which



10

and R<sub>1</sub> and E, independently, are selected from the group consisting of hydrogen, C<sub>1</sub>-C<sub>9</sub> straight or branched chain alkyl, C<sub>2</sub>-C<sub>9</sub> straight or branched chain alkenyl, aryl, heteroaryl, carbocycle, and heterocycle;

15 R<sub>2</sub> is carboxylic acid or a carboxylic acid isostere; wherein said alkyl, alkenyl, alkynyl, aryl, heteroaryl, carbocycle, heterocycle, or carboxylic acid isostere is optionally substituted with one or more substituents

selected from R<sup>3</sup>, where

R<sup>3</sup> is hydrogen, hydroxy, halo, halo(C<sub>1</sub>-C<sub>6</sub>)-alkyl, thiocarbonyl, (C<sub>1</sub>-C<sub>6</sub>)-alkoxy, (C<sub>2</sub>-C<sub>6</sub>)-alkenoxy, (C<sub>1</sub>-C<sub>6</sub>)-alkylaryloxy, aryloxy, aryl-(C<sub>1</sub>-C<sub>6</sub>)-alkyloxy, cyano,

5 nitro, imino, (C<sub>1</sub>-C<sub>6</sub>)-alkylamino, amino-(C<sub>1</sub>-C<sub>6</sub>)-alkyl, sulfhydryl, thio-(C<sub>1</sub>-C<sub>6</sub>)-alkyl, (C<sub>1</sub>-C<sub>6</sub>)-alkylthio, sulfonyl, C<sub>1</sub>-C<sub>6</sub> straight or branched chain alkyl, C<sub>2</sub>-C<sub>6</sub> straight or branched chain alkenyl or alkynyl, aryl, heteroaryl, carbocycle, heterocycle, or CO<sub>2</sub>R<sup>4</sup> where R<sup>4</sup> is  
10 hydrogen or C<sub>1</sub>-C<sub>3</sub> straight or branched chain alkyl or alkenyl;  
or a pharmaceutically acceptable salt, ester, or solvate thereof;

Preferred embodiments of this embodiment of the  
15 invention are those in which R<sub>2</sub> is a carbocycle or heterocycle containing any combination of CH<sub>2</sub>, O, S, or N in any chemically stable oxidation state, where any of the atoms of said ring structure are optionally substituted in one or more positions with R<sup>3</sup>.

20 Especially preferred embodiments of this aspect of the invention are the use of those compounds in which R<sub>2</sub> is selected from the group below: